10/16/92 KE

Health Assessment for

PETITIONED PUBLIC HEALTH ASSESSMENT

AMERICAN CHEMICAL SERVICES INC.

GRIFFITH, LAKE COUNTY, INDIANA

CERCLIS NO. IND016360265

October 16, 1992

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

Comment Period Ends:

NOVEMBER 24, 1992

THE ATSDR HEALTH ASSESSMENT: A NOTE OF EXPLANATION

Section 104 (i) (7) (A) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, states "...the term 'health assessment' shall include preliminary assessments of potential risks to human health posed by individual sites and facilities, based on such factors as the nature and extent of contamination, the existence of potential pathways of human exposure (including ground or surface water contamination, air emissions, and food chain contamination), the size and potential susceptibility of the community within the likely pathways of exposure, the comparison of expected human exposure levels to the short-term and long-term health effects associated with identified hazardous substances and any available recommended exposure or tolerance limits for such hazardous substances, and the comparison of existing morbidity and mortality data on diseases that may be associated with the observed levels of exposure. The Administrator of ATSDR shall use appropriate data, risks assessments, risk evaluations and studies available from the Administrator of EPA."

In accordance with the CERCLA section cited, this Health Assessment has been conducted using available data. Additional Health Assessments may be conducted for this site as more information becomes available.

The conclusions and recommendations presented in this Health Assessment are the result of site specific analyses and are not to be cited or quoted for other evaluations or Health Assessments.

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Agency for Toxic Substances
and Disease Registry
Atlanta GA 30333

October 16, 1992

Mr. Wayne M. Hartwick
EPA Region V
77 West Jackson Boulevard
6th Floor - M/S HSRL-6J
Chicago, Illinois 60604

Dear Mr. Hartwick:

Enclosed please find a copy of the Agency for Toxic Substances and Disease Registry (ATSDR) Petitioned Public Health Assessment-Public Comment Release for the American Chemical Services Inc. Site, dated October 16, 1992. This document is ATSDR's evaluation of data and information on the release of contaminants into the environment from the American Chemical Services Inc. Site, Griffith, Lake County, Indiana. The purpose of this document is to assess any current or future impact on public health.

The ATSDR will accept written comments from the public until November 24, 1992. Comments should be addressed to: Ms. Lydia Odgen Askew, Community Involvement Liaison, Division of Health Assessment and Consultation, ATSDR, Mailstop E-32, 1600 Clifton Road, N.E., Atlanta, Georgia 30333.

If you have any questions, please do not hesitate to call Ms. Ogden Askew, at (404) 330-9543 (24-hour message service).

Sincerely yours,

Max M. Howie, Jr.
Chief
Records and Information Management Branch
Division of Health Assessment
and Consultation

Enclosure

Public Notice
Griffith, Indiana

The Agency for Toxic Substances and Disease Registry Public Health Assessment for the American Chemical Services site will be available on October 26, 1992, at the following repository:

Griffith Public Library
940 North Broad Street
838-2825

The Public Comment Period will run October 26-November 24, 1992. Comments postmarked after that time will not be considered. Comments received during the public comment period will be logged and become part of the administrative record for the Public Health Assessment. Comments and responses will be included in an appendix to the final Public Health Assessment. Commenters' names will not be included in the Public Health Assessment, however, they are subject to Freedom of Information Act requests. For that reason, individuals should exercise their own judgment concerning the inclusion of any personal health information or other confidential data in comments sent to ATSDR. Only written comments will be accepted. Comments should be directed to:

Lydia Ogden Askew
Community Involvement Liaison
ATSDR (E32)
1600 Clifton Road, NE
Atlanta, GA 30333

If sufficient public comments are received, a public meeting may be held. Please contact Louise Fabinski at 312/886-0840 or Ms. Ogden Askew at 404/330-9543 (24 hours) if you have questions.

To run in: Griffith News (weekly)
219/924-5631
Week preceding public comment period

PETITIONED PUBLIC HEALTH ASSESSMENT

AMERICAN CHEMICAL SERVICES INC.

GRIFFITH, LAKE COUNTY, INDIANA

CERCLIS NO. IND016360265

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment-Public Comment Release was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6), and in accordance with our implementing regulations 42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate. This document represents the Agency's best efforts, based on currently available information, to fulfill the statutory criteria set out in CERCLA section 104 (i)(6) within a limited timeframe. To the extent possible, it presents an assessment of the potential risks to human health. Actions authorized by CERCLA section 104 (i)(11), or otherwise authorized by CERCLA, may be undertaken to prevent or mitigate human exposure or risks to human health. In addition, ATSDR will utilize this document to determine if follow-up health actions are appropriate at this time.

This document has been provided to EPA and the affected state in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. Where necessary, it has been revised in response to comments or additional relevant information provided by them to ATSDR. This revised document has now been released for a 30 day public comment period. Subsequent to the public comment period, ATSDR will address all public comments and revise or append the document as appropriate. The public health assessment will then be reissued. This will conclude the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

Comments regarding this report are welcome. Please address to:

Agency for Toxic Substances and Disease Registry
Attn: Director, Division of Health Assessment and Consultation (E-32)
1600 Clifton Road, N.E., Atlanta, Georgia 30333

Agency for Toxic Substances and Disease Registry.....*William L. Roper, M.D., M.P.H. Administrator*
Barry L. Johnson, Ph.D., Assistant Administrator

Division of Health Assessment and Consultation.....*Robert C. Williams, P.E., Director*
Juan J. Reyes, Deputy Director

Federal Programs Branch.....*Sally L. Shaver, Chief*

Community Health Branch.....*Cynthia M. Harris, Ph.D., Chief*

Remedial Programs Branch.....*Sharon Williams-Fleetwood, Ph.D., Chief*

Records & Information Management Branch.....*Max M. Howie, Jr., Chief*

Emergency Response & Consultation Branch.....*C. Harold Emmett, P.E., Chief*

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services

SUMMARY

Extensive on-site subsurface soil and groundwater contamination have been found at the American Chemical Services National Priorities List (NPL) site in Griffith, Lake County, Indiana. Groundwater contamination has migrated off site, but has not infiltrated local residential wells. One unused industrial supply well contained lead at levels of public health concern. It is unlikely that lead contamination is related to the American Chemical Services NPL site, however, because lead was not detected in groundwater at or near the NPL site, and analyses of a sample from an upgradient private well just south of the contaminated industrial supply well did not find lead.

Using the available information, the Agency for Toxic Substances and Disease Registry (ATSDR) concludes that the American Chemical Services NPL site is a public health hazard because existing groundwater contamination could migrate into local residential wells. ATSDR also concludes that additional surface soil sampling (0-3 inches) should be conducted at the Kapica/Pazmey area to better characterize the extent of contamination. Environmental contamination at the Griffith Municipal Landfill has not been fully characterized. Soil gas analysis should be conducted to evaluate the extent of landfill gas generation and migration. Although there is no documentation indicating human exposure to site-related contaminants, there are community health concerns that should be addressed. ATSDR will provide community health education during meetings with petitioners and the general public.

BACKGROUND

A. SITE DESCRIPTION AND HISTORY

The American Chemical Services, Inc. (ACS) National Priorities List (NPL) site is in Griffith, Indiana (See Appendix, Figure I). Although the site is named after ACS, the U.S. Environmental Protection Agency (EPA) has specified that the NPL site includes the ACS property (19 acres), the Pazmey Corporation property (2 acres; a.k.a. Kapica Drum Incorporated), and the inactive portion of the Griffith Municipal Landfill (15 acres) (1).

Six areas of probable waste disposal have been identified at the NPL site. Those six areas have been assigned the following designations by EPA and ACS management: the On-Site Containment area, the Still Bottoms area, the Treatment Lagoon #1, the Off-Site Containment area, the Kapica/Pazmey area, and the Griffith Municipal Landfill (see Appendix, Figure II) (1).

ACS began operations as a solvent recovery facility in May 1955. Manufacturing of small batches of specialty chemicals was first begun in the late 1960s and early 1970s. Solvent recovery and production of specialty chemicals continued to 1990. ACS was ordered to cease accepting hazardous wastes as of September 1990. ACS's interim status, RCRA regulated, hazardous waste storage facility is currently undergoing RCRA closure.

Waste generated from ACS operations was disposed at various locations at the ACS property (On-Site Containment area, Still Bottoms area, Treatment Lagoon #1, and Off-Site Containment area). Still bottoms (material left after the usable solvent has been reclaimed) from the solvent recovery process were disposed in the Still Bottoms Pond and Treatment Lagoon #1 from 1955 to 1972. Part of Treatment Lagoon #1 might have been incorporated into the present-day fire pond when it was constructed in November 1973.

Between 1958 and 1975, the Off-Site Containment area was used as a waste disposal area. A variety of wastes were disposed in the Off-Site Containment area, including still bottoms from the Still Bottoms Pond and Treatment Lagoon #1, ash from the two incinerators that operated from 1966 through 1970, general refuse, an estimated 20,000 - 30,000 drums, and a tank truck partially full of solidified paint. It is reported that the drums were punctured before disposal (1).

During the mid-1960s, approximately 400 drums containing sludge and semi-solids of unknown types were reportedly disposed in the On-Site Containment area (1).

Still bottoms from ACS solvent reclamation operations are disposed off site in permitted facilities. Waste solvents are

either disposed of off site at RCRA-permitted facilities or in the ACS secondary fuel-blending program. Waste water originating from the solvent reclamation, small batch, and epoxidation operations, as well as non-contact cooling water and water from boiler blowdown operations is routed to the City of Griffith sewer system (1).

The Griffith Municipal Landfill has operated since the 1950s. Before RCRA was implemented of RCRA, wastes from ACS and Kapica Drum were reportedly disposed at the landfill, however, the landfill denies accepting any waste from Kapica or ACS. Currently, the landfill accepts solid waste (1).

Kapica Drum operated as a drum reconditioning facility from 1951 through 1980. Rinse water from drums containing hazardous wastes was reportedly disposed on the property, as were liquids from the drums to be reconditioned. Liquid waste from the drum-washing operations reportedly flowed onto ACS property intermittently between 1962 and 1983. Kapica Drum was sold to Pazmey Corporation in February 1980. The Pazmey Corporation sold the property to a private individual in March 1987. The property is currently used to store boats and cars (1).

The site was added to the NPL in August 1984. The Remedial Investigation (RI) of the ACS site is being conducted by the ACS Potentially Responsible Parties (PRPs). Warzyn Engineering Inc. is the consultant for the PRPs. The RI environmental sampling was conducted from July 1989 through August 1990. The ACS PRP submitted draft RI report to EPA in November 1990 (1). Additional sampling was conducted in January 1991 and August 1991.

In June 1989, the Agency for Toxic Substances and Disease Registry (ATSDR) was petitioned by local citizens to evaluate public health concerns associated with the ACS site. ATSDR accepted the petition in January 1990. This public health assessment is being conducted to address the concerns of the petitioners. In addition to responding to the petition, ATSDR is required by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, to conduct a public health assessment for every site included on or proposed for the NPL. In November 1988, ATSDR conducted a preliminary public health assessment on the ACS site.

B. SITE VISIT

Mr. Sven E. Rodenbeck and Ms. Louise Fabinski from ATSDR conducted a site visit on April 25-27, 1990. During the site visit, ATSDR staff met with representatives of the Indiana State Board of Health, the Lake County Health Department, Warzyn Engineering Inc., and EPA. In addition, ATSDR staff met with the citizens who petitioned the agency in June 1989.

While at the ACS site, ATSDR staff observed the areas of contamination. Information on the number and location of residential wells was obtained from Warzyn Engineering Inc. and the Lake County Health Department.

Both the ACS area and the Griffith Municipal Landfill are fenced. Other parts of the NPL site have been fenced since the RI began.

C. DEMOGRAPHICS, LAND USE, AND NATURAL RESOURCE USE

The ACS site is within the corporate boundaries of the City of Griffith. Approximately 50 individuals are employed by ACS. The area surrounding the site is primarily industrial; three major railroads intersect northwest of the site. The nearest residents are across Colfax Avenue, approximately 200 feet east of the site boundary.

A residential well survey conducted by Warzyn Engineering Inc. indicates 16 wells are within a half-one mile radius of the ACS site (see Appendix, Figure III) (1). It is estimated that 40 individuals (men, women, and children) rely on the 16 wells for potable water (drinking and cleaning). Most Griffith residents obtain their potable water from the municipal system, which derives its water from Lake Michigan.

According to the 1990 U.S. Census (Tract Numbers 409 and 410), the City of Griffith has a population of 17,916 (94.7% white, 2.4% black, and 2.9% other). The population of Griffith has increased approximately 5% since the 1980 U.S. Census was conducted. The percentage of the population older than age 18 was about 75% (70.8% white, 2.0% black, and 2.2% other). The 1990 U.S. Census indicates 6,914 housing units are within the City of Griffith.

The ACS site is surrounded by marsh areas to the north, west, and southwest. Hunting or fishing is not conducted on site and unlikely to occur in the surrounding marshes.

D. HEALTH OUTCOME DATA

The State of Indiana Board of Health provided information from its cancer registry for the population of Griffith and the State (Cancer Incidence for 1987-89 and Cancer Mortality Rates for 1970-79). In addition, ATSDR reviewed cancer mortality data from 1950-1979 on Lake County and the State of Indiana Riggans Cancer Mortality database. The Riggans database is maintained on the Centers for Disease Control computer mainframe.

COMMUNITY HEALTH CONCERNS

During the April 1990 site visit, ATSDR talked with the individuals who petitioned the Agency about their health concerns

related to the ACS site. The petitioners believe there is a high frequency of cancer occurring within an 8-block area north of the site. The cancers reported are bladder, breast, brain, uterus, lung, and leukemia.

The petitioners also informed ATSDR about an oil and solvent discharge from the Griffith Airport. Because residents near the airport previously relied on wells for potable water (all residents near the airport were connected to the municipal water system in the fall of 1989), the petitioners are concerned that the oil and solvent discharge from the Griffith Airport could have resulted in additional exposures to hazardous substances. The petitioners urged ATSDR to sample residential wells.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

The tables in this section list the contaminants of concern. Those contaminants are evaluated in subsequent sections of this public health assessment to determine whether human exposure to them is of public health concern. ATSDR selects and discusses contaminants based upon the following factors:

- concentrations of contaminants on and off the site;
- field data quality, laboratory data quality, and sample design;
- comparison of on-site and off-site concentrations with public health assessment comparison values for noncarcinogenic and carcinogenic endpoints;
- comparison of on-site and off-site concentrations with background concentrations, if available; and
- community health concerns.

The tables that follow under the On-site Contamination and Off-site Contamination subsections list contaminants of concern. Human exposure to contaminants listed may not necessarily result in adverse health effects. Instead, the list indicates contaminants that will be evaluated further in this public health assessment.

Comparison values for this public health assessment are contaminant concentrations in specific media used to select contaminants for further evaluation. Those values include Environmental Media Evaluation Guides (EMEGs), Cancer Risk Evaluation Guides (CREGs), and other relevant guidelines. CREGs are estimated contaminant concentrations based on the expected occurrence of one excess cancer in a million persons exposed over a lifetime. CREGs are calculated from EPA's cancer slope factors. *EPA's Proposed Maximum Contaminant Levels (PMCLs) are*

Maximum Contaminant Levels (MCLs) proposed for adoption by EPA. The MCL represents contaminant concentrations that EPA deems protective of public health (considering the availability and economics of water treatment technology) over a lifetime (70 years) at an exposure rate of 2 liters water per day. The MCLs are regulatory concentrations. EPA's Reference Doses (RfDs) are estimates of the levels of daily exposure to contaminants unlikely to cause adverse health effects.

A. ON-SITE CONTAMINATION

Contaminants of concern in each medium at the ACS site are listed in Tables 1 - 4. All analytical results in this subsection were collected by Warzyn Engineering during the RI process from July 1989 through August 1990 (1) and during additional sampling in January 1991 and August 1991.

Waste Material and Subsurface Soil

Organic chemical (e.g., trichloroethene and benzene) contamination was found in the waste material and subsurface soil (greater than one foot) samples at similar levels at the On-Site Containment, Still Bottoms, Treatment Lagoon #1, Fire Pond, and Off-Site Containment areas (Table 1). Except for polychlorinated biphenyls (PCBs), much lower organic chemical contamination was found at the Kapica/Pazmey area. The maximum concentration of PCBs was detected in waste material; the Off-site Containment area contained the highest concentration of PCBs in soil. The Kapica/Pazmey area soil contained concentrations of PCBs ranging from 0 - 27 mg/Kg at depths of 0 - 1 foot and from 0 - 42 mg/Kg at depths of 3 - 4.5 feet. The highest concentration of metals (lead, barium, and cadmium) in the soil was found at the Kapica/Pazmey area. Subsurface soil samples collected at depths of 3 feet in the Kapica/Pazmey area contained concentrations of lead ranging from 5,810 - 10,700 mg/kg. The next highest levels of metals contamination in soil were found at the Still Bottom area (1). No waste material or subsurface soil samples were taken at the Griffith Municipal Landfill (1).

Table 1

Range of Contaminant Concentrations in On-Site Waste Material and Subsurface Soil

Contaminant	Concentration Range (mg/kg)	Comparison Value (mg/kg)	Source
Waste Material			
Trichloroethene	<0.005-1,700	1	RfD
Benzene	<0.005-7,100	2	CREG
Tetrachloroethene	<0.005-5,900	500	RfD
Xylene (Total)	<0.005-25,000	100,000	RfD
Carbon Tetrachloride	<0.005-3,600	35	RfD
1,1,2-Trichloroethane	<0.005-320	12	CREG
Naphthalene	<0.33-2,400	200	RfD
1,1,1-Trichloroethane	<0.005-20,000	4,500	RfD
Toluene	<0.005-200,000	10,000	RfD
Polychlorinated biphenyls (PCBs)	<0.08-400	0.09	CREG
Lead	<0.005-16,200	*	
Barium	<42-1,560	3,500	RfD
Subsurface Soil			
Tetrachloroethene	<0.005-46,000	500	RfD
Trichloroethene	<0.005-19,000	1	RfD
Benzene	<0.005-46,000	2	CREG
Chloroform	<0.005-2,800	20	EMEG
Methyl Isobutyl Ketone	<0.01-2,500	2,500	RfD
Vinyl Chloride	<0.01-160	2	EMEG
1,1,1-Trichloroethane	<0.005-150,000	4,500	RfD
1,1,2-Trichloroethane	<0.005-400	12	CREG
Xylene (Total)	<0.005-100,000	100,000	RfD
Methyl Ethyl Ketone	<0.01-99,000	2,500	RfD
PCB	<0.08-250	0.09	CREG
Lead	<0.005-17,200	*	
Barium	<42-1,780	3,500	RfD
Cadmium	<0.1-1,700	1	EMEG

NOTE:

mg/kg - milligrams per kilogram (ppm - parts per million)
CREG - Cancer Risk Evaluation Guide
EMEG - Environmental Media Evaluation Guide
RfD - Reference Dose
* - No Comparison Value

Source: Warzyn Engineering, Inc. Draft Remedial Investigation Report, ACS NPL Site, Griffith, Indiana. Chicago, Illinois: Warzyn Engineering, Inc., 1990.

Surface Soil

Surface soil (0-3 inches) samples were not collected during the RI process. All of the waste material at the On-Site Containment, Still Bottoms, Treatment Lagoon #1, Fire Pond, and Off-Site Containment areas are covered with several feet of clean soil (1). Therefore, it is not necessary to sample surface soils at those locations. However, waste liquids and rinse water from drums were discarded directly onto the Kapica/Pazmey surface soils. Surface soil samples from that area would have been useful to determine PCB and metal concentrations in the top soil. That type of data is needed because people are more likely to contact surface than subsurface soils.

Leachate

Leachate samples were taken at the Griffith Municipal Landfill. Analysis of the samples showed elevated levels of organic chemicals and metals originating from the landfill (Table 2) (1).

Table 2

Range of Contaminant Concentrations in On-Site Leachate

Contaminant	Concentration Range (mg/L)	Comparison Value (mg/L)	Source
Benzene	<0.005-0.006	0.001	CREG
Methyl Ethyl Ketone	<0.005-0.83	2	RfD
Barium	<0.005-2.37	0.7	RfD
Lead	<0.005-1.37	0.005	PMCL
Manganese	<0.005-9.3	1	RfD
Chromium (Total)	<0.005-0.288	0.05	EMEG
Mercury	<0.0002-0.00098	0.003	RfD

NOTE:

mg/L - milligrams per liter (ppm - parts per million)
CREG - Cancer Risk Evaluation Guide
EMEG - Environmental Media Evaluation Guide
RfD - Reference Dose
PMCL - Proposed Maximum Contaminant Level

Source: Warzyn Engineering, Inc. Draft Remedial Investigation Report, ACS NPL Site, Griffith, Indiana. Chicago, Illinois: Warzyn Engineering, Inc., 1990.

Surface Water and Sediment

Surface water and sediment samples were taken in the marshlands surrounding the ACS site. Analysis of those samples showed benzene and lead on site at levels above comparison values (Table 3). Benzene and lead were not detected at levels above the comparison values beyond the boundaries of the site (1).

Table 3

Range of Contaminant Concentrations in On-site Surface Water and Sediment

Contaminant	Concentration Range (mg/L)	Comparison Value (mg/L)	Source
Surface Water			
Benzene	<0.005-0.46	0.001	CREG
Lead	<0.005-0.0238	0.005	PMCL
Sediment	(mg/kg)	(mg/kg)	
Benzene	<0.005-14	0.001	CREG
Lead	<20-702	*	

NOTE:

mg/L - milligrams per liter (ppm - parts per million)
CREG - Cancer Risk Evaluation Guide
PMCL - Proposed Maximum Contaminant Level
* - No Comparison Value

Source: Warzyn Engineering, Inc. Draft Remedial Investigation Report, ACS NPL Site, Griffith, Indiana. Chicago, Illinois: Warzyn Engineering, Inc., 1990.

Groundwater

Extensive groundwater monitoring (three rounds) has been conducted by Warzyn Engineering at the ACS site (1). Analysis of the groundwater samples indicates that many of the organic chemical and metal soil contaminants have migrated into the upper water table aquifer (Table 4). No contamination at levels above the comparison values was found in the lower aquifer.

Table 4

Range of Contaminant Concentrations
On-Site Groundwater

Contaminant	Concentration Range (mg/L)	Comparison Value (mg/L)	Source
Benzene	<0.005-100	0.001	CREG
Toluene	<0.005-2.3	2	RfD
Ethylbenzene	<0.01-1.1	1	RfD
Xylene (Total)	<0.005-3.0	20	RfD
PCB	<0.001-0.0026	0.000005	CREG
Chloroethane	<0.005-2.0	0.5	Rfd
Vinyl Chloride	<0.01-0.72	0.00002	CREG
1,1-Dichloroethane	<0.01-2.4	1	RfD
1,2-Dichloroethane (Total)	<0.01-0.4	0.0004	CREG
Methyl Ethyl Ketone	<0.01-220	2	RfD
Methyl Isobutyl Ketone	<0.01-54	2	RfD
2-Hexanone	<0.01-1.8	0.3	RfD
Arsenic	<0.005-0.03	0.01	EMEG
Barium	<0.005-1.8	0.7	RfD
Manganese	<0.005-4.2	1	RfD

NOTE:

mg/L - milligrams per liter (ppm - parts per million)
CREG - Cancer Risk Evaluation Guide
EMEG - Environmental Media Evaluation Guide
RfD - Reference Dose

Source: Warzyn Engineering, Inc. Draft Remedial Investigation Report, ACS NPL Site, Griffith, Indiana. Chicago, Illinois: Warzyn Engineering, Inc., 1990.

Air

No air samples were collected during the RI.

As discussed in the Site Description and History section, the major operations at ACS were solvent recovery and chemical manufacturing. During operations, the same chemicals found at the NPL site could be released to the environment. In order to identify whether ACS discharged additional amounts of site-related chemicals to the environment, ATSDR searched the 1987 and 1988 Toxic Chemical Release Inventory (TRI). TRI is a database developed by EPA from chemical release (air, water, and soil) information provided by certain industries. TRI indicates that ACS discharged to the air six chemicals

of concern at the NPL site (1,1,1-trichloroethane, xylene (total), trichloroethene, tetrachloroethene, methyl ethyl ketone, and toluene). The highest air discharges were reported in 1988 (1,1,1-trichloroethane, 452 pounds per year (lbs/yr); xylene (total), 3,671 lbs/yr; trichloroethene, 302 lbs/yr; tetrachloroethene, 72 lbs/yr; methyl ethyl ketone, 5,765 lbs/yr; and toluene 6,190 lbs/yr). All of the reported levels of discharged chemicals are estimated, preventing comparison of the analytical levels for the contaminants found at the NPL site and the ACS discharge to air.

B. OFF-SITE CONTAMINATION

Groundwater

Off-site migration of contaminated upper aquifer groundwater has been confirmed by the Warzyn Engineering investigation. Groundwater samples were collected from off-site monitoring wells and off-site private wells drawing groundwater from the upper and lower aquifers (See Appendix, Figures III and IV). Table 5 lists the contaminants of concern found in the off-site groundwater. Warzyn Engineering collected the environmental data presented in this subsection during the RI process from July 1989 through August 1990 (1).

The highest groundwater contamination was found in off-site upper aquifer monitoring wells near the ACS site (1). Groundwater from off-site private wells did not contain any site-related contaminants. One private well contained lead at levels (0.0417 mg/L) above the comparison value of 0.005 mg/L. This private well is an unused industrial supply well north of the site (private well PW-07, see Appendix, Figure III) (1).

In addition to determining what ACS is discharging to the environment, TRI was searched to determine whether other industries in Griffith are discharging site-related contaminants. TRI did not contain any other information on similar toxic chemical releases in the Griffith area.

Table 5

Range of Contamination Concentrations in Off-Site Monitoring Wells and the Private Industrial Supply Well

Contaminant	Concentration Range (mg/L)	Comparison Value (mg/L)	Source
Monitoring Wells			
Benzene	<0.005-0.012	0.001	CREG
Trichloroethene	<0.005-0.045	0.003	CREG
Tetrachloroethene	<0.005-0.20	0.0007	CREG
PCB	<0.0001-0.027	0.000005	CREG
Industrial Supply Well			
Lead	<0.003-0.0417	0.005	PMCL

NOTE:

mg/L - milligrams per liter (ppm - parts per million)
CREG - Cancer Risk Evaluation Guide
PMCL - Proposed Maximum Contaminant Level

Source: Warzyn Engineering, Inc. Draft Remedial Investigation Report, ACS NPL Site, Griffith, Indiana. Chicago, Illinois: Warzyn Engineering Inc., 1990.

C. QUALITY ASSURANCE AND QUALITY CONTROL

ATSDR was provided with quality assurance and quality control (QA/QC) information about the RI analytic data, indicating that appropriate QA/QC was performed for the samples collected by Warzyn Engineering. The conclusions presented in this public health assessment are based in part on the data presented in the RI report. The validity of the conclusions, therefore, depends on the accuracy and reliability of the data provided.

D. PHYSICAL AND OTHER HAZARDS

No physical or other hazards were noted during the ATSDR site visit, except those normally found at an industrial area.

PATHWAYS ANALYSES

A. ENVIRONMENTAL PATHWAYS (Fate and Transport)

Contaminants of concern could migrate through several environmental pathways. The two primary environmental pathways are groundwater and surface water. To help readers of this assessment better understand pathways, regional hydrogeologic conditions are explained; potential environmental pathways are also discussed.

Regional Hydrogeological Conditions

The ACS site is on the lake bed of ancient glacial Lake Chicago. The landscape is generally low-lying, and predominantly the result of continental glacial processes and processes associated with the formation of glacial Lake Chicago and the present-day Lake Michigan. Those glacial processes deposited varying layers of sand, gravel, and clay on top of the regional bedrock. Glacial deposits close to the site are approximately 130 feet thick.

Glacial deposits near the ACS site can be divided into three units: an upper sand and gravel unit, an intermediate silty clay unit, and a lower sand and gravel unit. Groundwater is found in both the upper and lower sand and gravel units. The intermediate, silty clay unit acts as a dividing layer between the two groundwater aquifers. This dividing layer, called an aquitard, inhibits the flow of groundwater between the two groundwater aquifers.

Groundwater flow within the upper sand and gravel aquifer follows the contours of the local topography and is influenced by activities at the Griffith Municipal Landfill. Groundwater within the upper aquifer tends to flow in all directions. Groundwater from the upper aquifer discharges north, northeast, west, and southwest to the local marshes and ditches surrounding the NPL site. Groundwater flow south and east has not been completely evaluated, but it appears that Turkey Creek is a discharge point for groundwater flowing in those directions. The upper aquifer is the source of water for a few residences, however, upper aquifer water is not considered potable. (see Appendix, Figure III).

The lower sand and gravel aquifer is used extensively as a source of potable water. Groundwater in this aquifer flows north and eventually discharges into Lake Michigan.

Surface-water runoff at the site is west and south into local marshes, which drain into Turkey Creek.

Groundwater Pathway

In the past, waste from ACS and Kapica Drum operations was disposed on site. Most of the waste from ACS was buried on site (On-Site Containment area, Still Bottoms area, Treatment Lagoon #1, and Off-Site Containment area). Liquid waste from Kapica Drum was discharged onto

the ground. Some waste from the two facilities might have been sent to the Griffith Municipal Landfill. Since the waste was discarded, various toxic substances in it have migrated through the soil into the groundwater (see Tables 4 and 5). Groundwater monitoring data indicate contamination at levels above comparison values is restricted to the upper sand and gravel aquifer. Groundwater contamination in the aquifer is moving in the direction of groundwater flow, but has not migrated very far off site. Analysis of samples taken from local residential wells did not show site-related contaminants; therefore, it is unlikely people have been exposed to the contaminated groundwater. If the migration of contaminated groundwater is not prevented, contaminants from the site could migrate into residential wells.

Results of private well samples showed that one unused industrial supply well (PW-07) was contaminated with lead at levels above comparison values. The lead contamination is probably not related to the ACS site because lead was not detected in groundwater at or near the site, and analyses of a sample from an upgradient private well just south of PW-07 also did not find lead.

Surface Water Pathway

As previously discussed, the upper aquifer discharges into local marshes, ditches, and Turkey Creek. In addition, surface-water runoff from the site and leachate from the Griffith Municipal Landfill drain into the same bodies of water. Analysis of surface-water and sediment samples from the marshes and ditches on site showed site-related contaminants (lead and benzene) at levels above comparison values. Those on-site contaminants probably are the result of migration of contaminated groundwater, surface-water runoff, and leachate. People probably would not contact contaminants on site because access is restricted by a fence. The levels of contamination steadily decrease with distance from the sources of contamination and are at or below background levels before surface water exits the site boundaries. It is therefore unlikely that off-site fish or wildlife have bioaccumulated site-related contaminants.

Waste Material and Soil

Analysis of soil and waste samples taken at the ACS site indicate the soil is contaminated at levels above comparison values at the On-Site Containment, Still Bottoms, Treatment Lagoon #1, Off-Site Containment, and Kapica/Pazmey areas. Contamination at the On-Site Containment, Still Bottoms, Treatment Lagoon #1, and Off-Site Containment areas is located several feet below the surface. People probably will not contact the soil contamination except during excavation of the soil. Groundwater will continue to be contaminated, however, unless the site is remediated.

The Kapica/Pazmey area subsurface soil has elevated concentrations of PCBs and metals. Some contaminants may be in the surface soils (0-3 inches) because drum rinse water and liquid waste were reportedly

discharged directly onto the ground. Wind erosion, traffic patterns (truck movement), and surface-water runoff could transport those contaminants off site. Surface soil sampling is needed to confirm whether contamination is of public health concern.

Air

Although no air monitoring was conducted on site, it is unlikely that significant amounts of site-related contaminants are being released into the air because most of the volatile contaminants (e.g., benzene) are several feet below the soil surface. Routine air monitoring with hand-held instruments (e.g., organic vapor analyzer) did not detect air contamination except when subsurface soils were excavated.

One possible environmental pathway that has not been investigated is whether methane gas is being generated at and migrating from the Griffith Municipal Landfill. As solid waste material decomposes, methane is produced. Because waste material from ACS and Kapica Drum were reported to be disposed in the landfill, it is likely that hazardous substances are in the landfill. Therefore, methane and volatile hazardous substances (e.g., benzene) could travel through the unsaturated soil, above the groundwater, into nearby buildings. Analysis of landfill gas should be conducted to evaluate that possible pathway, and gas monitoring should be a part of an overall environmental monitoring and control program for the landfill (e.g., groundwater monitoring and control of contaminant migration).

B. HUMAN EXPOSURE PATHWAYS

Using information from the environmental pathways evaluation, there do not appear to be current or past human exposures to site-related contaminants at levels of public health concern.

Groundwater monitoring data clearly indicate that no site-related contaminants have migrated to potable water wells (e.g., residential wells). In the future, however, contaminated groundwater could enter local residential wells and people could be chronically exposed to site-related contaminants at levels of public health concern. The contaminants most likely to migrate into local residential wells are benzene, trichloroethene, and tetrachloroethene, the primary constituents of the groundwater contaminant plume that has migrated off site.

Most of the soil contamination (On-Site Containment, Still Bottoms, Treatment Lagoon #1, and Off-Site Containment areas) is under several feet of clean soil, which would prevent human exposure except when the soil is excavated. If the subsurface soil contamination is excavated, people could ingest, inhale, or have skin contact with it. Standard dust control and personal protective procedures should prevent that type of exposure.

There may be some surface soil contamination with PCBs and heavy metals (lead, barium, and cadmium) in the Kapica/Pazmey area. If surface soil in that area is contaminated, people could ingest, inhale, or have skin contact with contaminants. The Kapica/Pazmey area is visited only to move stored boats and cars, therefore, any human exposure is not likely to be significant. Surface soil must be sampled before this pathway can be evaluated further.

Analysis of off-site surface water and sediments did not show contamination at levels above background or of public health concern. People probably would not ingest on-site fish or wildlife that have bioaccumulated lead or other site-related contaminants because there is no on-site fishing or hunting.

PUBLIC HEALTH IMPLICATIONS

A. TOXICOLOGIC EVALUATION

Although many contaminants were detected at the ACS site at levels of public health concern, available information indicates there are no completed human exposure pathways. If the contaminants continue to migrate, however, people could be exposed to groundwater contamination by way of ingestion, skin contact, or even inhalation. The groundwater contaminants most likely to migrate into local residential wells are benzene, trichloroethene, and tetrachloroethene; their toxicologic implications are discussed in the following paragraphs. Because the three compounds have similar toxicologies, they are discussed together.

In addition, surface soil in the Kapica/Pazmey area (on-site) may be contaminated. If so, people could ingest, inhale, or have skin contact with the PCBs and heavy metals (lead, barium, and cadmium). The toxicologic implications of the compounds also are discussed.

Benzene, Trichloroethene, and Tetrachloroethene

Studies of workers indicate that benzene, trichloroethene, and tetrachloroethene effects depend on the amount and length of exposure. Inhalation and skin contact were the routes of exposure examined during most of those studies. Exposure to 10 ppm benzene, 50 ppm trichloroethene or 50 ppm tetrachloroethene in the air can cause eye, nose, and throat irritation. As an individual's exposure increases, central nervous system effects appear, including headaches, dizziness, poor coordination, and loss of memory. Skin irritation, nausea, vomiting, and diarrhea can occur, as well as loss of feeling and/or pain in the hands or feet (2,3,4).

Exposure to high levels of those chemicals in the air can damage the lungs, liver, and kidneys. Chronic exposure to lower amounts can also affect those organs. Animals with long-term exposure to trichloroethene appear to have immune system effects. Short-term benzene exposure also

affects the immune systems of animals. It has not been determined whether tetrachloroethene affects the immune systems of people or animals (2,3,4).

All three chemicals have been evaluated for their ability to cause cancer. Benzene is considered a human carcinogen; studies of human exposures to trichloroethene and tetrachloroethene are not considered adequate to prove or disprove an association. Results of some animal studies indicate tetrachloroethene could cause cancer in humans. Trichloroethene studies in animals are not adequate to make conclusions about its ability to cause cancer (2,3,4).

The ability of those chemicals to affect the reproductive process or the fetus (i.e., cause birth defects) has been evaluated. Animals tests indicate that high doses of benzene, trichloroethene, and tetrachloroethene can cause both reproductive effects and birth defects. Those studies are inconclusive, however, on whether the chemicals could cause such effects in people (2,3,4).

How benzene, trichloroethene, and tetrachloroethene enter people's bodies can influence the health effects experienced. When inhaled or ingested, a high percentage of the chemicals move into the bloodstream. The health effects of ingestion, therefore, could be similar to inhalation of equivalent concentrations. The health effects of skin contact are probably not similar to those of inhalation or ingestion because less of the chemicals move from the skin into the bloodstream (2,3,4).

Whether or not health effects occur is affected by how long it takes the body to process (metabolize) and eliminate a chemical and how much of the chemical is stored. As exposure continues slow metabolism and/or long-term storage results in a steady decrease in the amount needed to cause health effects. Benzene, trichloroethene, and tetrachloroethene are eliminated from the body in a few days to a week. Little or nothing is stored in the body (2,3,4).

PCBs

PCBs are chemicals that were manufactured until 1977 for use as coolants and lubricants in transformers and other electrical equipment. PCBs can still be found in older electrical equipment, and there is extensive, low-level PCB contamination of the environment (5).

Studies of human exposure indicate that PCBs can irritate the skin and cause liver effects. Those studies did not identify the relationship between dose and effect. Limited evidence from human studies suggests that PCBs can cause cancer, reproductive effects, and birth defects (5).

PCBs can enter the body by way of inhalation, ingestion, or skin contact. The rate at which PCBs enter the body through those routes has not yet been clearly identified (5).

PCBs are metabolized and eliminated from the body with in days, or they can be stored in the body for years. The rate of elimination and amount stored depends on the type of PCB exposure (5).

Lead

Exposure to lead causes a wide range of effects. Short-term exposures above 0.05 ppm in air affect the central nervous system (headaches, dizziness, etc.) and gastrointestinal tract (nausea, diarrhea, and vomiting). Higher amounts can affect the production of blood, kidney and heart functions, and behavior. Long-term exposure of adults to lead above 0.05 ppm in water has similar effects, it also causes blood pressure to rise. Lead is strongly linked with decreases in IQ, mood disorders, memory loss, poor coordination, and decreased function of the thyroid and adrenal glands. Children are especially sensitive to lead; the same effects are observed in them at half the concentration (6).

Lead is considered a possible human carcinogen based on studies in experimental animals. Investigations of an association between lead exposure and cancer in workers have produced contradictory results (6).

Lead can affect both the reproductive process and development of the fetus. Effects include reduced production of sperm, premature birth, low birth weight, and after birth-learning disabilities (6).

Lead enters the blood much easier by way of inhalation and ingestion than by skin contact. It is eliminated slowly from the body; much of it is stored in the bones. Because lead remains in the body, the amount needed to cause an effect decreases as length of exposure increases (6).

Barium

There is not much information on barium's effects on people's health. Studies of a small number of people who ingested large doses of barium showed effects on the respiratory, cardiovascular, and central nervous systems and on the liver, kidney, and spleen. Lower concentrations of barium, however, are often used in making x-rays of the stomach or intestine and have never been found to be harmful. There are no valid data on whether barium causes cancer, birth defects, or reproductive effects in humans or animals (7).

Barium enters the blood much easier by way of inhalation than ingestion. It is very difficult for barium to enter the body following skin contact. Barium is eliminated from the body in one to two weeks; whatever remains is stored in the bones. It is not known whether the stored barium causes health effects (7).

Cadmium

Exposure to cadmium causes a variety of health effects in humans. Ingestion of 0.1 milligram cadmium per kilogram body weight per day (mg/kg/day) can cause nausea, vomiting, and diarrhea. Inhalation of

more than 0.1 ppm cadmium in air causes irritation of the respiratory tract. Long-term exposure can damage the kidneys and lungs. Limited evidence from human studies suggests that cadmium can cause lung cancer, but there is no evidence that cadmium causes birth defects or reproductive problems in people (8).

Data from animal studies indicates that cadmium can cause cancer, reproductive and birth defects, and liver damage, and that the metal affects the immune and central nervous systems (8).

Cadmium enters the blood much easier by way of inhalation than by ingestion. Cadmium does not easily enter the body by way of skin contact. Cadmium is eliminated slowly from the body; much of it is stored in the bones. Because it remains in the body, the amount needed to cause an effect decreases as length of exposure increases (8).

B. Health Outcome Data Evaluation

The primary health concern of the individuals who petitioned ATSDR (see Community Health Concerns section) is a high frequency of cancer occurring within an 8-block area north of the ACS site. The types of cancers reported are breast, brain, uterus, and leukemia.

As indicated in the Human Exposure Pathways section, there is no documentation indicating that human exposures to site-specific contaminants are occurring or have occurred. Therefore, it is unlikely that the health outcomes reported by the petitioners are associated with the ACS site.

Cancer of the breast or uterus has not been shown to be associated with environmental agents (9). Cancers of the lung, brain, and colon-rectum, and leukemia, have been associated with environmental agents. Two of the most important environmental factors associated with cancer are tobacco use (up to 35% of cancer deaths) and diet (up to 35% of all cancer deaths). Some hazardous substances have been associated with specific types of cancer (e,g. occupational asbestos exposure and lung cancer, occupational benzene exposure and leukemia, and residential radon exposure and lung cancer) (10).

In an attempt to address this community health concern, the Indiana State Board of Health provided ATSDR with 1987-1989 cancer incidence data for the City of Griffith from the Indiana Cancer Registry and with 1970-1979 site-specific cancer mortality rates by race and gender for the United States, Indiana, and Lake County. In addition, ATSDR reviewed 1950-1979 cancer mortality data for Lake County from the Riggans Cancer Mortality database.

Review of the incidence data showed percentages of site-specific cancers for Griffith (population 17,916 - 1990 U.S. Census) to be comparable to percentages for U.S. as a whole. The four types of cancer that occurred most often in Griffith were lung, colon-rectum, cervix, and breast. Review of mortality rates showed more deaths than expected in Lake

County for all cancer sites combined compared to the State of Indiana. The data were limited; it was not possible to identify cases occurring in the 8-block area of concern to the petitioners. Information is not available on numbers of specific cancers and characteristics of the affected persons.

A health statistics review could be conducted in the future, when the Indiana Cancer Registry will have additional years of data and the ability to identify cases occurring in the 8-block area of concern. A health statistics review could better quantify and characterize the specific cancer cases of concern to the petitioners and help identify public health education needs.

C. Community Health Concerns Evaluation

During the April 1990 site visit, ATSDR listened to community health concerns of the individuals who petitioned the Agency.

1. The petitioners believe there ares high frequencies of breast, brain, uterus, lung, and leukemia cancer occurring in an 8-block area north of the ACS site.

As indicated in the Human Exposure Pathways and Health Outcome Data Evaluation sections, there is no documentation human exposure to site-related contaminants. Therefore, it is unlikely that the human health outcomes reported by the petitioners are associated with the ACS site.

2. The petitioners are concerned that the oil and solvent discharge from the Griffith Airport might have contaminated their residential wells.

As a result of information provided by the Indiana State Board of Health, EPA, and ATSDR, the Indiana Department of Environmental Management (IDEM) conducted a preliminary assessment in February 1991, and a site investigation in October 1991, on the Griffith Airport oil and solvent discharge. IDEM concluded that no further remedial action for the Griffith Airport is warranted.

CONCLUSIONS

1. Using available information, ATSDR considers the American Chemical Services NPL site an indeterminate public health hazard. ATSDR needs additional information on surface soil in the Kapica\Pazmey area to determine whether there would be a health impact if individuals contact potentially contaminated, on-site surface soil.

2. ATSDR found no evidence of current or past exposure of residents to site-related contaminants. As long as waste material and contaminated soil remain, however, the contaminants can migrate into the groundwater. It is possible that the groundwater contamination could migrate to residential wells. The site could

become a public health hazard in the future if residents are chronically exposed to contaminants at concentrations currently detected in the off-site monitoring wells.

3. One unused industrial supply well contained lead at levels of public health concern (0.0417 mg/L). It is unlikely that the lead contamination is related to the ACS; however, lead was not detected in groundwater at or near the site and analyses of a sample from an upgradient private well south of the contaminated private well did not find lead.

4. Data are inadequate in the following areas:

   a. ATSDR concludes that additional surface soil sampling (0 to 3 inches) should be conducted at the Kapica/Pazmey area. To better characterize the extent of surface-soil contamination.

   b. Environmental contamination at the Griffith Municipal Landfill has not been fully characterized. Soil gas analysis should be conducted to evaluate the extent of landfill gas generation and migration.

   c. Cancer incidence and cancer mortality data are limited by the inability to identify cases occurring in the 8 block area of concern to the petitioners. In addition, the numbers of specific cancers and characteristics of the affected persons are not available.

RECOMMENDATIONS

Cease/Reduce Exposure Recommendations

1. To prevent them from being exposed to site contaminants, workers conducting remedial activities should follow appropriate Occupational Safety and Health Administration (OSHA) standards and National Institute of Occupational Safety and Health (NIOSH) recommendations.

2. Dust and vapor control measures should be implemented to prevent on and off-site exposure to site-related contaminants during excavation of waste material and contaminated soil.

Site Characterization Recommendations

1. Monitoring for site-related contaminants should be conducted quarterly at residential wells downgradient of the site. Appropriate procedures should be used to prevent human exposure to off-site migration of groundwater contamination.

2. Surface-soil sampling (0-3 inches) should be conducted to better characterize the extent of contamination at the Kapica/Pazmey area.

Appropriate procedures should be used to prevent exposure to potential surface soil contamination in the area.

3. The extent of landfill gas generation and migration from the Griffith Municipal Landfill should be determined. Appropriate procedures should be used to prevent people from being exposed to landfill gasses. The landfill gas monitoring should be part of an overall environmental monitoring and control program for the landfill (e.g., groundwater monitoring and control of contaminant migration).

Health Follow-up

1. When adequate cancer incidence data from the Indiana Cancer Registry become available, an in-depth health statistics review should be conducted to determine whether there is a high frequency of cancer occurring within the 8-block area identified by the local citizens.

2. When indicated by public health needs, the evaluation of additional relevant environmental data, health outcome data, and community health concerns, if available, is recommended.

Health Activities Recommendation Panel Recommendations

The American Chemical Services NPL site, Griffith, Lake County, Indiana, has been evaluated by the ATSDR Health Activities Recommendation Panel (HARP) to determine future health-related activities ATSDR should conduct at this site. Although there is no documentation indicating that people are being exposed to site-related contaminants, there are public concerns that should be addressed. HARP has made the following recommendation:

1. ATSDR should provide public health education during meetings with the petitioners and the general public.

Public Health Actions

In response to community concerns, and based on the conclusions and recommendations of the health assessors and HARP, the following actions either have been or will be performed.

ATSDR in cooperation with the Indiana State Board of Health, will conduct the following public health actions:

1. Discuss the findings of the public health assessment and community health concerns with the petitioners.

2. Evaluate additional environmental data, health outcome data, and community health concerns when indicated by public health need.

EPA, in cooperation with Indiana Department of Environmental Management will conduct the following actions:

1. Ensure OSHA standards and NIOSH recommendations are used during site remediation to protect workers from exposure to site contaminants.

PREPARERS OF REPORT

Sven E. Rodenbeck, PE
Environmental Engineer
Remedial Programs Branch

Ugo Ivey, MD
Medical Officer
Community Health Branch

Jack E. Hanley
Environmental Health Scientist
Remedial Programs Branch

ATSDR Regional Representative

Louise A. Fabinski
Senior Public Health Advisor
Region V

REFERENCES

1. Warzyn Engineering Inc. Remedial Investigation Report, ACS NPL Site, Griffith, Indiana. Chicago: Warzyn Engineering, 1990.

2. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Benzene. Atlanta: ATSDR, 1988.

3. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Trichloroethylene. Atlanta: ATSDR, 1988.

4. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Tetrachloroethylene. Atlanta: ATSDR, 1988.

5. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Selected PCBs. Atlanta: ATSDR, 1988.

6. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Lead. Atlanta: ATSDR, 1988.

7. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Barium. Atlanta: ATSDR, 1991.

8. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Cadmium. Atlanta: ATSDR, 1988.

9. DiVita VT, Hellman S, Rosenburg SA, eds. Cancer: Principles and Practices of Oncology. 3rd ed. Philadelphia: J.B. Lippincott, 1989.

10. American Cancer Society. Cancer Facts & Figures - 1991. Atlanta: American Cancer Society, 1991.

APPENDIX

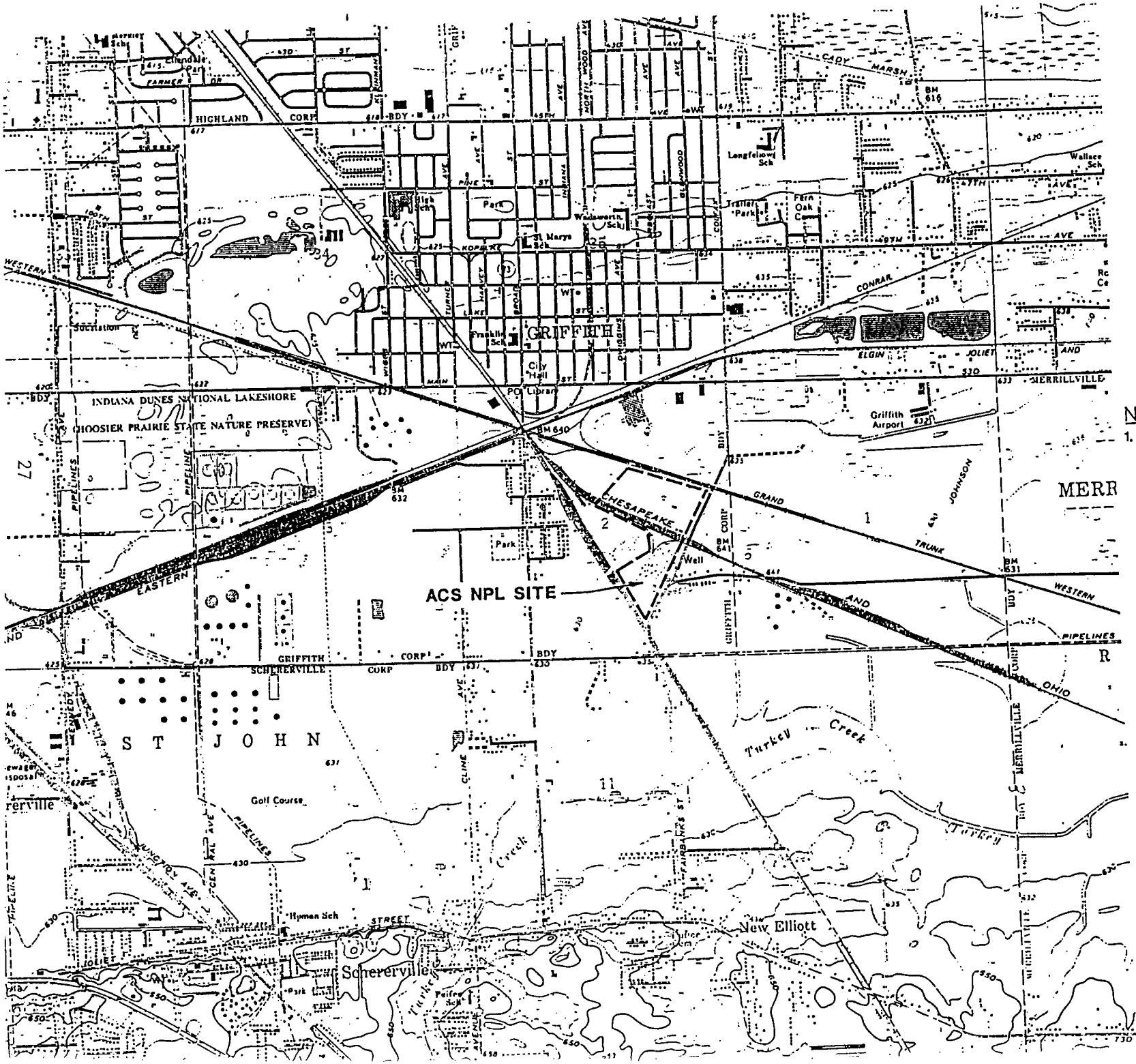


FIGURE I.

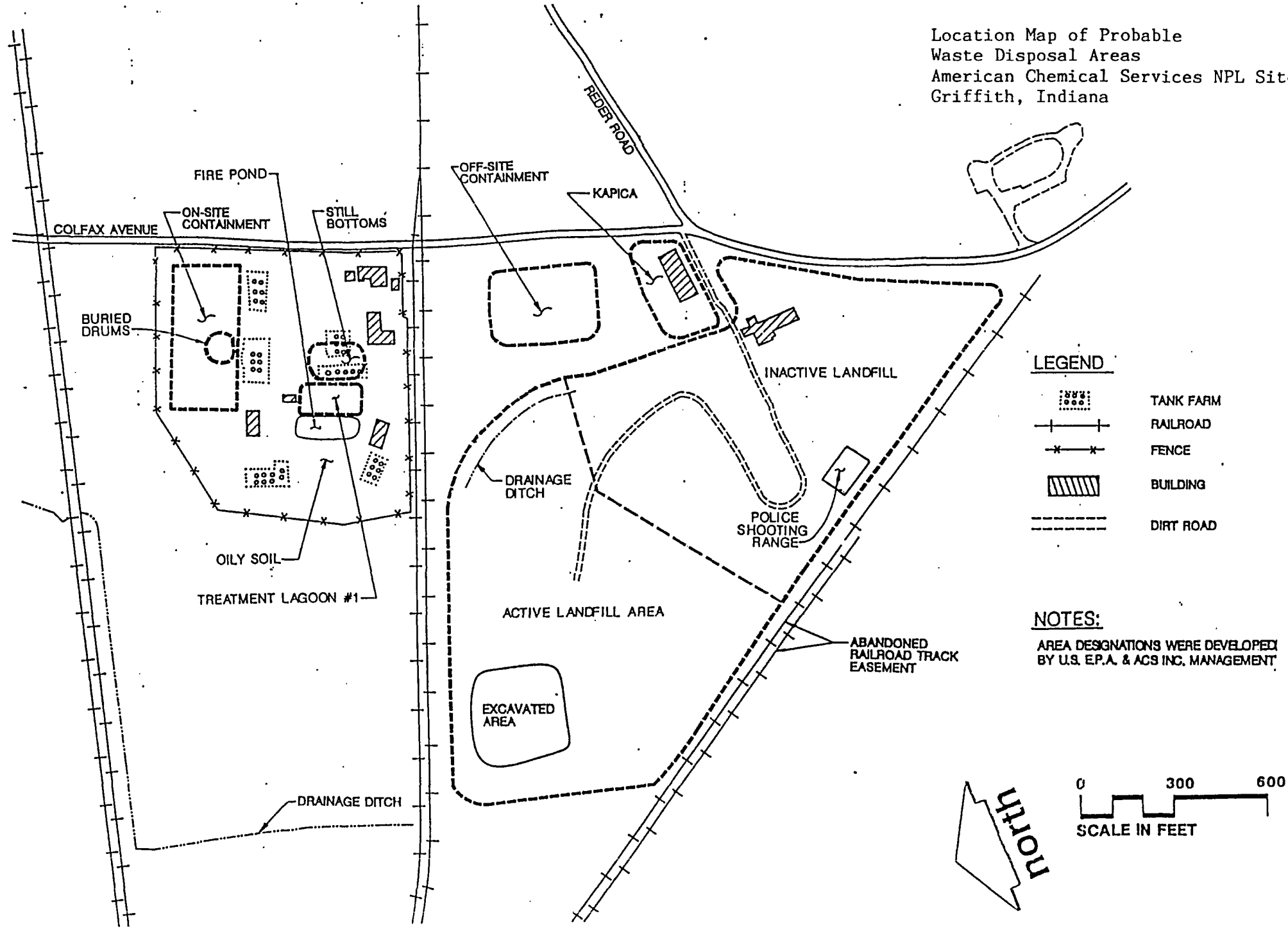
Location Map for the American Services NPL Site Griffith, Indiana

NOTES

1. BASE MAP DEVELOPED FROM HIGHLAND & ST. JOHN, INDIANA 7.5 MINUTE USGS TOPOGRAPHIC QUADRANGLE MAPS DATED 1968 AND 1962, RESPECTIVELY, PHOTOREVISED 1980.

FIGURE II.

Location Map of Probable
Waste Disposal Areas
American Chemical Services NPL Site
Griffith, Indiana



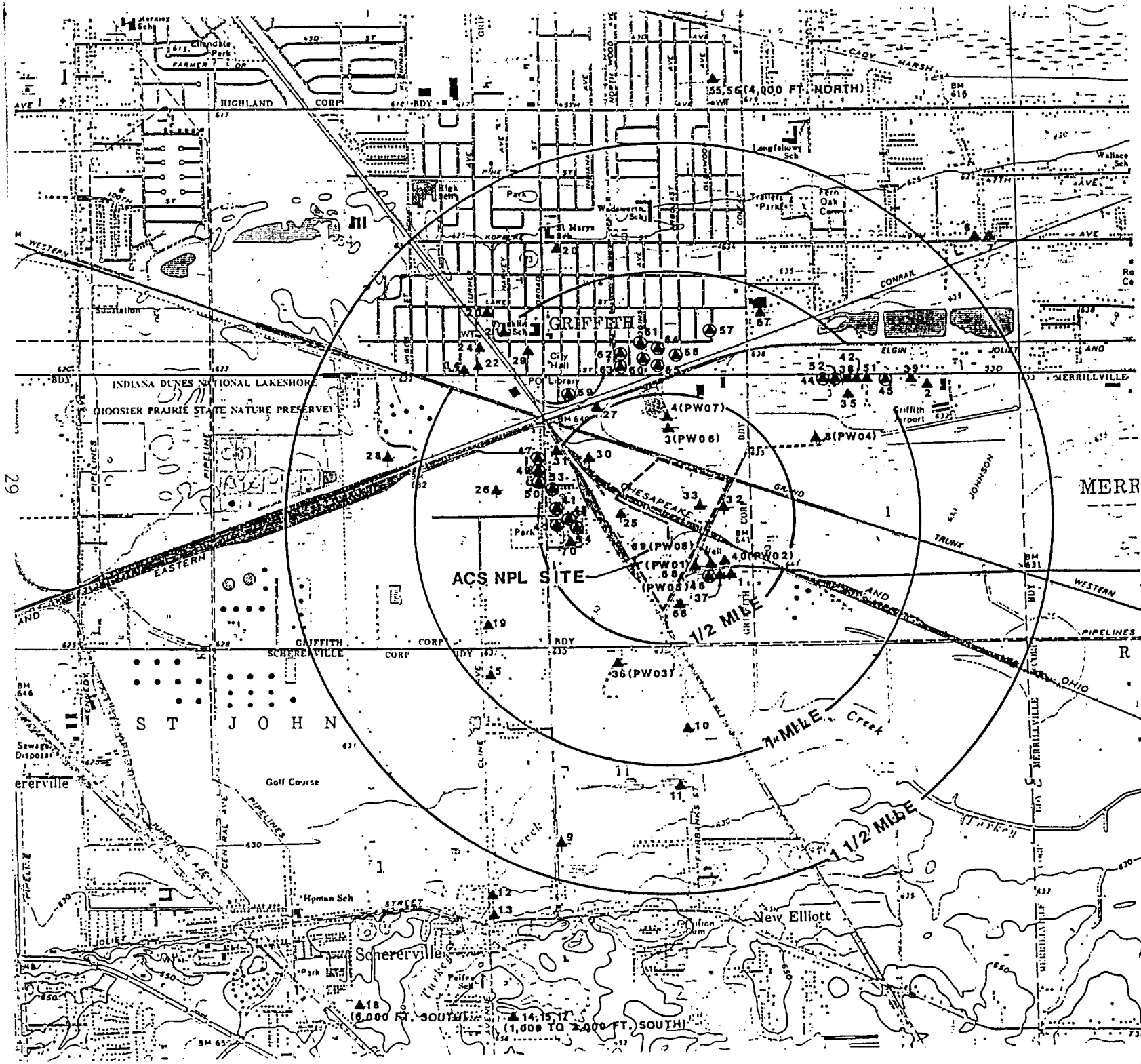


FIGURE III.

Location Map of Private Wells near the American Chemical Services NPL Site, Griffith Indiana

LEGEND

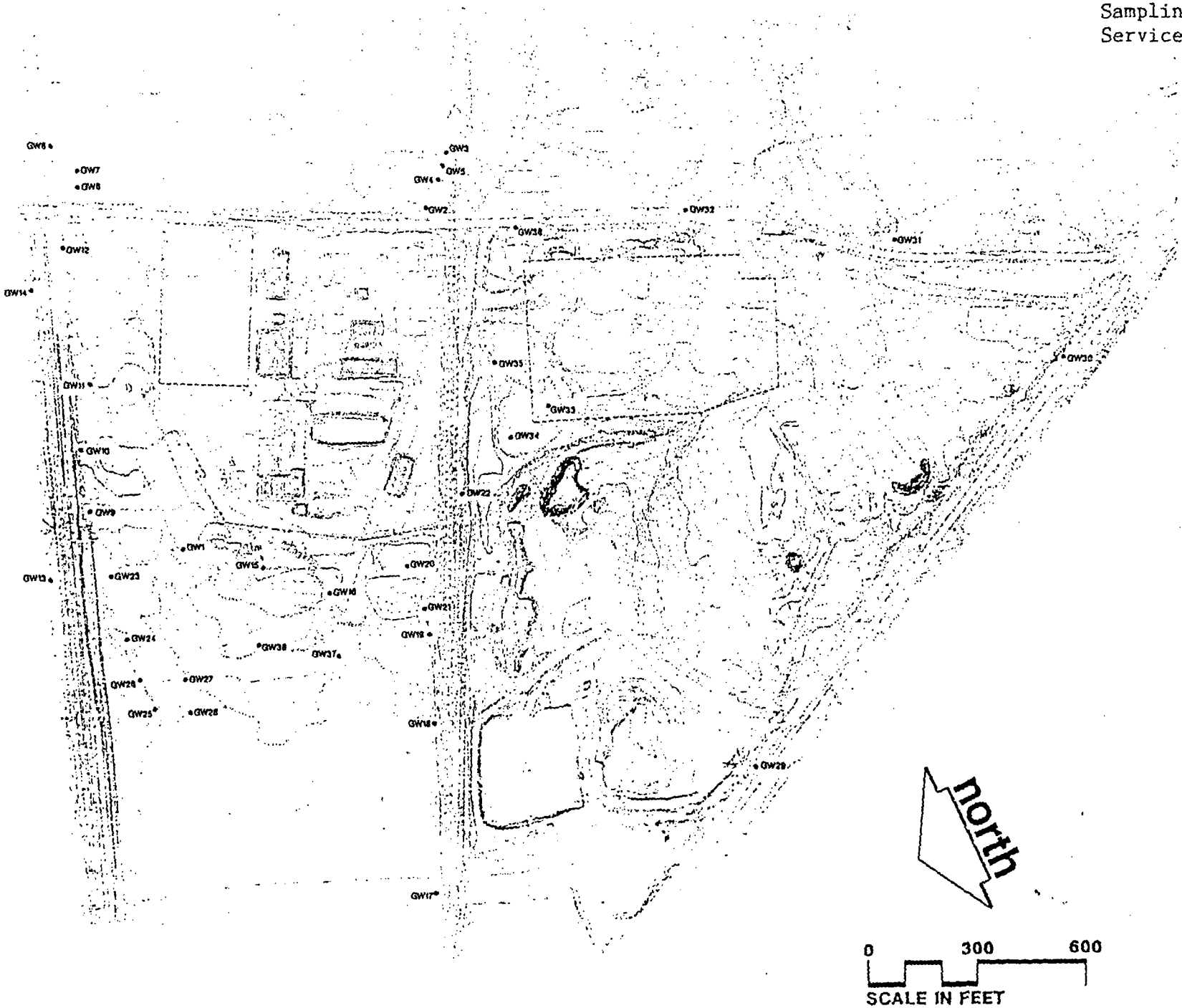
- ▲ UPPER AQUIFER PRIVATE WELL LOCATION
- ▲ LOWER AQUIFER PRIVATE WELL LOCATION
- (PW01) PRIVATE WELL SAMPLING LOCATION

NOTES

1. BASE MAP DEVELOPED FROM HIGHLAND & ST. JOHN, INDIANA 7.5 MINUTE USGS TOPOGRAPHIC QUADRANGLE MAPS DATED 1968 AND 1962 RESPECTIVELY, PHOTOREVISED 1980.
2. PRIVATE WELL DATA WAS OBTAINED FROM THE INDIANA DEPARTMENT OF NATURAL RESOURCES, DIVISION OF WATER WELL LOGS, OR A USEPA SURVEY, OR A WARZ DOOR TO DOOR SURVEY.
3. SUMMARY OF PRIVATE WELLS LOCATED ON THIS MAP IS INCLUDED IN TABLE 2-6.
4. INDIANA DEPARTMENT OF NATURAL RESOURCES WELL LOGS ARE INCLUDED APPENDIX L.
5. PRIVATE WELL SAMPLING WAS CONDUCTED BY WARZYN ENGINEERING INC. ON JUNE 13 & 14, 1990.

Location Map of Groundwater Sampling Points American Chemic Services NPL Site

Griffith Indian



LEGEND

—— GEOPHYSICS INVESTIGATION AR

•GW1 GROUNDWATER SAMPLING POINT LOCATION & NUMBER

NOTES

1. INITIAL BASE MAP WAS DEVELOPED FOR CAMP DRESSE MCKEE INC ON NOVEMBER 5, 1985. MAP HAS BEEN UPDA FROM AN AERIAL PHOTOGRAPH OF THE SITE FLOWN NOVEMBER 3, 1988 BY GEONEX CHICAGO AERIAL SURVEY, THE BASE MAP WAS UPDATED BASED ON THE AER PHOTOGRAPH BY GEONEX.
2. VERTICAL DATUM IS USGS DATUM. CONTOUR INTERVAL IS ONE FOOT.
3. ALL GROUNDWATER SAMPLE POINTS WERE PART OF A SHALL GROUNDWATER INVESTIGATION PERFORMED BY TRAC RESEARCH CORPORATION UNDER SUPERVISION BY WAR ENGINEERING INC. (MARCH 26, 1990 THROUGH APRIL 2, 1990).
4. GROUNDWATER WAS COLLECTED BY DRIVING HOLLOW PUS WITH DETACHABLE DRIVE POINTS TO A SPECIFIED DEPTH BEL THE WATER TABLE. A GROUNDWATER SAMPLE WAS COLLEC IN A 40 ML VOC VIAL. THE HEADSPACE OF EACH SAMPLE W ANALYZED FOR BENZENE, ETHYL BENZENE, TOLUENE, XYLEN AND TOTAL PETROLEUM HYDROCARBONS USING A PORTA VARIAN 3300 (PID) GAS CHROMATOGRAPH. ALL SAMPLE A ANALYTICAL EQUIPMENT WAS CONTAINED IN A 4-WHEEL DR TRACER VAN.
5. GROUNDWATER SAMPLE POINT LOCATIONS ARE APPROXIMAT
6. REPORT OF FINDINGS IS COMPILED IN APPENDIX J.